(19) Japan Patent Office (JP)
(11) Public Patent Disclosure Bulletin

(12) Public Patent Disclosure Bulletin No. (A):	61-270060
(43) Public Patent Disclosure Bulletin Date:	November 29, 1986
Request for Examination:	Not yet made
Number of Inventions:	1
Total Pages:	3

(51) Int. Cl. 4	Identification Code	Internal File Nos.
B 24 B 7/22		7512-3C

(54) Title of Invention: Wafer Polishing Method

(21) Patent Application No.: 60-112275
(22) Patent Application Date: May 2, 1985

(72) Inventor: Hamakuchi Tsuneo
NEC Corporation
33-1, Shiba 5-chome
Minato-ku, Tokyo

(72) Inventor: Enoue Kouji
NEC Corporation
33-1, Shiba 5-chome
Minato-ku, Tokyo

(71) Applicant: NEC Corporation
33-1, Shiba 5-chome
Minato-ku, Tokyo

(74) Agent: Iwasa Ihen, Patent Attorney

SPECIFICATION

1. Title of the Invention
   Wafer Polishing Method

2. Claims
   (1) A wafer polishing method characterized by mirror-finish polishing of a wafer, wherein there is mirror-finish polishing of a wafer by means of a wafer and a polishing plate established on a window through which light passes, arranged in a way in which they are introduced to a chemical solution facing each other, coincident to light that passes through said window irradiating the polishing plate and the wafer, and relative motion generated between the polishing plate and the wafer.

[Cont'd from P.1]

3. Detailed Explanation of Invention

[Industrial Field of Application]

This invention concerns a polishing method that mirror-finish polishes a wafer.

[Conventional Technology and Its Problems]

In the conventional method used in mirror-finish polishing a wafer, the method of processing the wafer uses a polishing liquid in which a wafer of silicon dioxide, for example, is suspended in an alkaline chemical solution and forces a macromolecular material such as polyurethane as the main component, into the polishing plate by means of relative motion of the polishing plate and the wafer. In order to accelerate the processing speed in the conventional method, the force pressing on the polishing plate must be extreme. However, because the polishing plate is composed of a viscoelastic body of polyurethane, etc. and an extreme amount of force is applied to the edge surface, the result on the edge surface is compromised due to deterioration of the surface plane.

Though there is also a chemical polishing method whereby a wafer is polished while immersed in the chemical solution, because of the tendency of the chemical solution to crystallize at etching speed, it has the substantial disadvantage of producing surface roughness.

[Objective of Invention]

The objective of this invention is to eliminate these disadvantages and to acquire a polishing method capable of mirror-finishing the surface of a wafer perfectly with processing efficiency.

[Composition of Invention]

This invention is a wafer polishing method characterized by mirror-finish polishing of a wafer, wherein there is mirror-finish polishing of a wafer by means of a wafer and a polishing plate established on a window through which light passes, arranged in a way in which they are introduced to a chemical solution facing each other, coincident to light that passes through said window irradiating the polishing plate and the wafer, and relative motion generated between the polishing plate and the wafer.

This invention is based upon the idea that it is possible to produce a mechanically smooth, mirror-finished wafer surface by means of irradiation of light on the wafer and in the chemical solution, where the reaction speed of the wafer and chemical solution accelerates due to optical or thermal excitation of the wafer surface and/or the chemical solution, and to the introduction of the chemical solution to and generating relative motion between the polishing plate and the wafer.

To be more precise in reference to the excitation of the wafer surface, when light wave length λ_1 has less than 1.08 eV of silicon band gap energy, for example, it is difficult to thermally heat a low concentrate Si plate but absorption by means of an

[Cont'd from P.2]

independent carrier on a high concentration Si plate is a way of substantially inducing thermal excitation, thus enabling an activity state.

Likewise, when light wave length λ_2 possesses more than 1.08 eV of silicon band gap energy, not only is the Si plate thermally heated, but because it is possible to excite and activate solid-state internal electronics, an activity state of excitation is created without being restricted by a high or low concentration Si plate. Furthermore, when light wave length λ_3 possesses more than 3.4 eV of Si Γ band transition energy, the pattern of the solid-state internal electronics of a Si plate is repeated, and an absorption coefficient (α) of light wave length λ_3 (ultraviolet light) of Si greater than that on an order of 10^5/cm enables an excitation activity state only in the immediate vicinity of the surfaces of the electronics.

As in the above, by optically or thermally exciting a wafer surface by means of light energy that irradiates a wafer, acceleration of the reaction speed of the polishing process becomes possible.

[Working Example]

Explanation of the working example of the polishing method of this invention is based upon the diagram.

Figure 1 is a diagram used to explain the first working example of this invention and illustrates a case in which a single crystal silicon plate is used as a wafer. A polishing plate 5 that possesses windows 4 through which light partially passes is established between a wafer 2 fastened to a rotation-capable support plate 1 and a mercury lamp light source 3. On this polishing plate large numbers of apertures 3mm in diameter used as windows 4 are established 2mm apart on non-woven polyurethane material that is glued to a quartz glass plate. The polishing plate 5 is supported by a rotation-capable support column 7 inside the tank 6 which is made of a transparent material, and the polishing plate 5 and the process surface of the wafer 2 are inserted inside the tank so as to be immersed in a 1 molar solution of fluorinated sodium.

The wafer 2 is pressed against the polishing plate 5 with a pressure of $10 g/cm^2$ and, while the UV light 9 from the light source 3 irradiates the process surface of wafer 2, passing through windows 4 of the polishing plate 5, by means of rotation of the polishing plate 5 and the wafer in the direction indicated in the diagram, the wafer 2 and the polishing plate 5 are set in relative motion and the wafer 2 is polished. By means of the irradiation of the UV light 9 the wafer 2 and the chemical solution 8 attain an activated state of excitation and because a reaction is easily achieved reaction speed increases, then, in order to abrade the surface of the wafer 2 with the polishing plate 5, the mechanical process is performed with the surface immersed which enables an increase in the processing speed while mirror-finishing the wafer.

When compared to a case in which a light source is not used, this working example was able to increase the processing speed 5-fold and both a surface cleaning and an excellent mirror finish were obtained.

In the working example above, the wafer is pressed against the polishing plate, polished, and a chemical solution utilized for its lubricating effect, however, it is best to use a method that lubricates the wafer surface that is not glued to the polishing plate.

[Cont'd from P.2]

Again, in the working example above and relative to the Si wafer, it is possible to use the method of this invention with other semiconductor single crystal substrates as well, such as GA, As, and InP.

Furthermore, as shown by the working example above, this invention is one that is not restricted but an appropriate selection and acquisition of type of light source, polishing plate materials, etc., is necessary.

[Results of Invention]

In the conventional method, in order to polish a wafer being held with high pressure, a polishing liquid is introduced to the viscoelastic polishing plate made of a macromolecular material such as polyurethane, etc. and, even though all wafers may receive a mirror finish, the large surface planes deteriorate. With this invention's

method, the wafer surface and/or the chemical solution is excited and activated not by a large amount of pressure but by light energy, processing speed accelerates due to an increase in reaction speed, and because it is possible to produce a mirror finish on a surface by abrading a wafer surface, it is possible to accurately and efficiently acquire a wafer with a superior surface plane.

4. Brief Explanation of Illustration

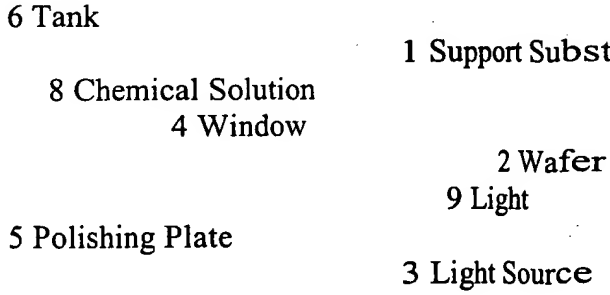


Figure 1

Figure No. 1 is an illustration that shows the condition of polishing by means of the polishing method of this invention.

1 Support Substrate
2 Wafer
3 Light Source
4 Window
5 Polishing Plate
6 Tank
7 Support Column
8 Chemical Solution
9 Light

Agent: Iwasa Ihen, Patent Attorney

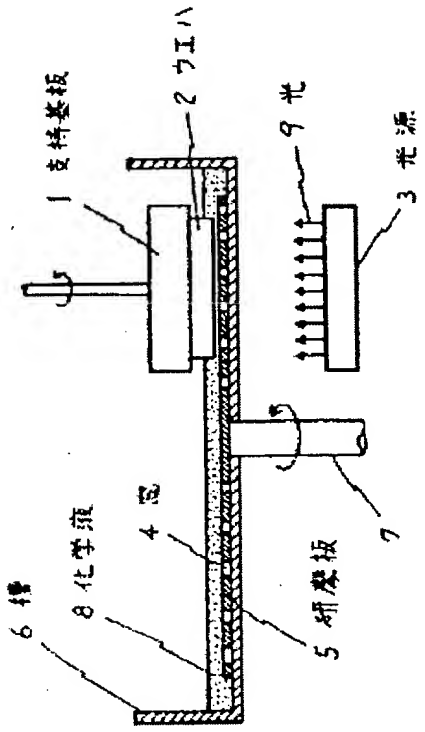
POLISHING METHOD FOR WAFER

Patent number: JP61270060
Publication date: 1986-11-29
Inventor: HAMAGUCHI TSUNEO; others: 01
Applicant: NEC CORP
Classification:
- international: B24B7/22
- european:
Application number: JP19850112275 19850527
Priority number(s):

Abstract of **JP61270060**

PURPOSE:To polish a wafer into mirror-finishing, by setting up the wafer and an abrasive plate provided with a window transmitting light so as to be opposed via a chemical solution, while making the wafer and the abrasive plate perform their relative motion via the chemical solution while irradiating the light to the chemical solution and the wafer through the said window.

CONSTITUTION:A wafer 2 is pressed to an abrasive plate 5 with a pressure of about 10g/cm<2>, and the wafer 2 and the abrasive plate 5 are rotated in an arrow direction via a chemical solution 8 kept in a tank 6 while irradiating ultraviolet rays 9 on a polishing surface of the wafer 2 through each window 4 of the abrasive plate. with this operation, the wafer 2 and the abrasive plate 5 start their relative motion, thus the wafer is polished. With irradiation of the ultraviolet rays 9, the wafer and/or the chemical solution 8 come into a state of being excited and activated, therefore they are easy to react so that a reaction velocity goes up and, what is more, a surface of the water 2 is subjected to friction, thus the surface is mechanically processed so smooth enough, making a removal rate increasable while polishing the wafer into mirror-finishing.



⑲日本国特許庁（JP）　⑪特許出願公開

⑫公開特許公報（A）　昭61－270060

⑤1Int.Cl.⁴　識別記号　庁内整理番号　⑬公開　昭和61年(1986)11月29日
B 24 B　7/22　7512－3C

審査請求　未請求　発明の数 1　（全3頁）

⑤4発明の名称　ウエハの研摩方法

⑳特　願　昭60－112275
㉒出　願　昭60(1985)5月27日

⑦2発明者　濱口　恒夫　東京都港区芝5丁目33番1号　日本電気株式会社内
⑦2発明者　江上　浩二　東京都港区芝5丁目33番1号　日本電気株式会社内
⑦1出願人　日本電気株式会社　東京都港区芝5丁目33番1号
⑦4代理人　弁理士　岩佐　義幸

明　細　書

1．発明の名称

ウエハの研摩方法

2．特許請求の範囲

（1）ウエハを鏡面研摩するにあたり、ウエハと、光を通す窓を設けた研摩板とを化学液を介して対向するように配置し、前記窓を通して化学液およびウエハに光を照射しながら、ウエハと研摩板とを化学液を介して相対運動させることにより、ウエハを鏡面研摩することを特徴とするウエハの研摩方法。

3．発明の詳細な説明

〔産業上の利用分野〕

本発明はウエハを鏡面研摩する研摩方法に関するものである。

〔従来技術とその問題点〕

ウエハの鏡面研摩に従来用いられている方法には、ウエハを例えば二酸化シリコンSiO_2をアルカリの化学液に懸濁した研摩液で、ポリウレタン等の高分子材料を主成分とする研摩板に押しつけて、研摩板とウエハとの相対運動により、ウエハを加工する方法がある。この従来の方法では加工速度を上げるためにはウエハの研摩板への押しつけ力を大きくしなければならない。しかし、研摩板はポリウレタン等の粘弾性体で構成されているため、ウエハの端面に大きな圧力が作用し、端面がだれる結果、平面度が悪化する欠点がある。

また、化学液中でウエハを研摩する化学研摩の方法があるが、化学液のエッチング速度の結晶方位による選択性のため、表面あらさが大きくなる欠点がある。

〔発明の目的〕

本発明の目的は、これらの欠点を除去せしめて、加工能率良くウエハ表面を鏡面にすることのできる研摩方法を得ることにある。

〔発明の構成〕

本発明は、ウエハを鏡面研摩するにあたり，ウエハと，光を通す窓を設けた研摩板とを化学液を介して対向するように配置し、前記窓を通して化学液およびウエハに光を照射しながら、ウエハと

研摩板とを化学液を介して相対運動させることにより，ウエハを鏡面研摩することを特徴としている。

本発明はウエハおよび化学液に光を照射することにより、ウエハ表面およびまたは化学液を光学的または熱的に励起することによりウエハと化学液との反応速度を促進し、かつ化学液を介して研摩板とウエハとを相対運動させることにより、ウエハ表面を機械的に滑らかに鏡面にできるという考えに基づいてなしたものである。

ウエハ表面の励起についてさらに詳しく述べると、波長λ_1の光が例えばシリコンのバンド間エネルギー1.08ｅＶより小さなエネルギを有するときは低濃度Ｓｉ基板は熱的に加熱されにくいが、高濃度Ｓｉ基板に対しては自由キャリアによる吸収が大きくなるので熱的に励起され、活性状態にすることができる。

また、波長λ_2の光が例えばＳｉのバンド間エネルギ1.08ｅＶより大きなエネルギを有するときは、Ｓｉ基板は熱的に加熱されるだけでなく、固体内電子を励起し活性化できるので、高濃度，低濃度Ｓｉ基板に限らず、励起活性状態となる。

さらに波長λ_3の光がＳｉのΓバンドの遷移エネルギ 3.4ｅＶより大きなエネルギを有するときは、Ｓｉ基板の固体内電子のみならず、波長λ_3の光（紫外光）のＳｉに対する吸収係数（α）が10^5／cmオーダ以上になり極めて表面付近の電子だけを励起活性化することができる。

以上のように、ウエハを照射する光のエネルギによりウエハ表面を光学的または熱的に励起させ、研摩加工の反応速度を促進させることが可能となる。

〔実施例〕

図面に基づき本発明の研摩方法の実施例について説明する。

第１図は本発明の一実施例を説明するための図であり、ウエハとして単結晶シリコン基板を用いた場合について述べる。

回転可能な支持基板１に接着したウエハ２と水銀ランプの光源３との間に、部分的に光を通す窓４を有する研摩板５を設ける。この研摩板には、窓４として直径３㎜の穴が２㎜間隔で多数設けられているポリウレタン不織布を石英ガラス板にはりつけたものを用いる。研摩板５は、透明な材料よりなる槽６内に回転可能な支柱７に支持されており、槽６内には化学液８としてフッ化ナトリウム１モル溶液を、ウエハ２の加工面と研摩板５とが浸るように入れる。

ウエハ２を圧力10ｇ／cmで研摩板５に押しつけ、研摩板の窓４を通してウエハ２の加工面に光源３から紫外光９を照射しながら槽６に保持された化学液８を介して、ウエハ２と研摩板５とを図示矢印の方向に回転することにより、ウエハ２と研摩板５とが相対運動をおこし、ウエハ２が研摩される。紫外光９を照射することにより、ウエハ２およびまたは化学液８が励起活性状態になり、反応しやすくなるため反応速度が上がり、さらに研摩板５によりウエハ２の表面を摩擦するため表面が滑らかに機械的に加工され、ウエハを鏡面にしながら加工速度を増加することができる。

本実施例によれば、光源を使用しない場合に比べて、加工速度を５倍に上げることができ、表面あらさも良好な鏡面が得られた。

以上の実施例では、ウエハを研摩板に押しつけて研摩したが、化学液の流体潤滑作用を利用して、研摩板に接触することなくウエハ表面を滑らかにする方法を用いてもよい。

また、以上の実施例では、シリコンウエハについて述べたが、他の半導体単結晶基盤例えばＧａＡｓ，ＩｎＰについても本発明の方法を用いることができる。

さらに本発明は以上の実施例に限定されるものではなく、光源の種類，研摩板の材料等についても適宜選択し得ることは勿論である。

〔発明の効果〕

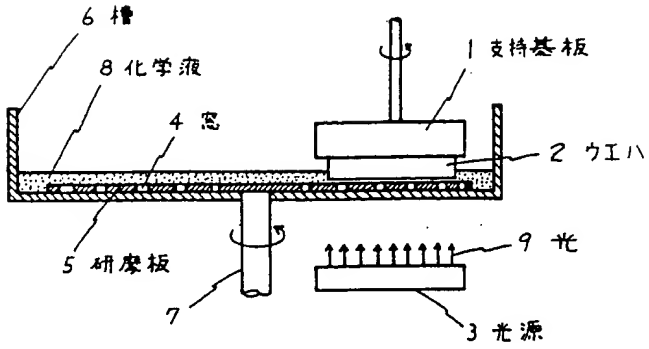
従来の方法では、例えばポリウレタン等の高分子材料からなる粘弾性体の研摩板に研摩液を介して、高圧で押しつけてウエハを研摩するために、ウエハ端面のだれも大きく平面度が悪化していたのに対し、本発明の方法によれば圧力を大きくす

ることなく光エネルギによってウエハ表面および または化学液を励起，活性化し、反応速度を増加させることにより加工速度を増し、がつウエハ表面を摩擦することにより表面を鏡面にしていくことができるので、平面度の優れたウエハを効率良く得ることができる。

4．図面の簡単な説明

第1図は本発明の研摩方法による研摩状態を示す図である。

1……支持基盤
2……ウエハ
3……光源
4……窓
5……研摩板
6……槽
7……支柱
8……化学液
9……光



第 1 図

代理人　弁理士　　岩　佐　義　幸